FIG.1

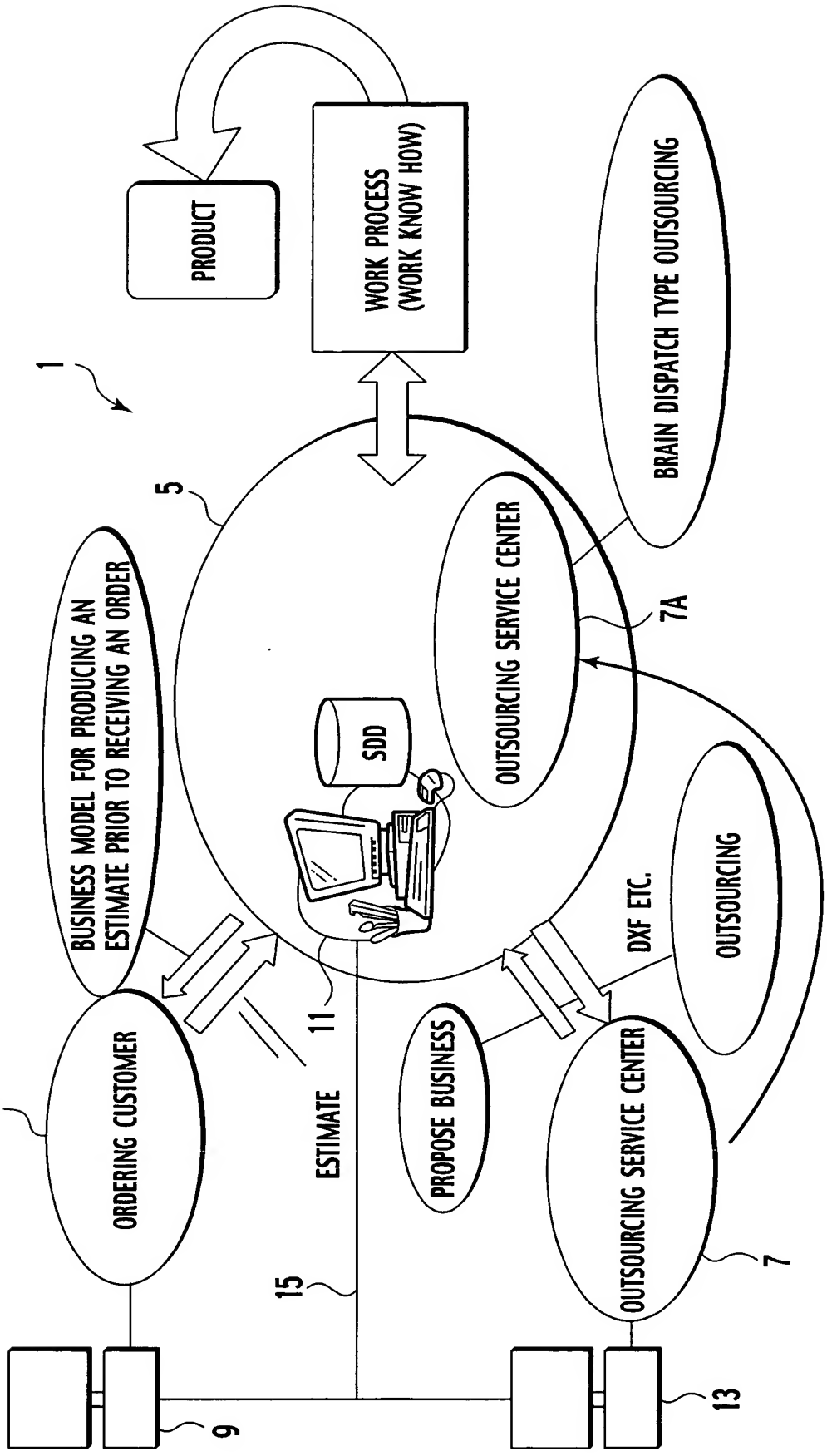

PRODUCT
WORK PROCESS (WORK KNOW HOW)
1
5
BRAIN DISPATCH TYPE OUTSOURCING
OUTSOURCING SERVICE CENTER
7A
BUSINESS MODEL FOR PRODUCING AN ESTIMATE PRIOR TO RECEIVING AN ORDER
SDD
DXF ETC.
OUTSOURCING
3
ORDERING CUSTOMER
11
ESTIMATE
PROPOSE BUSINESS
OUTSOURCING SERVICE CENTER
7
15
9
13

FIG.2

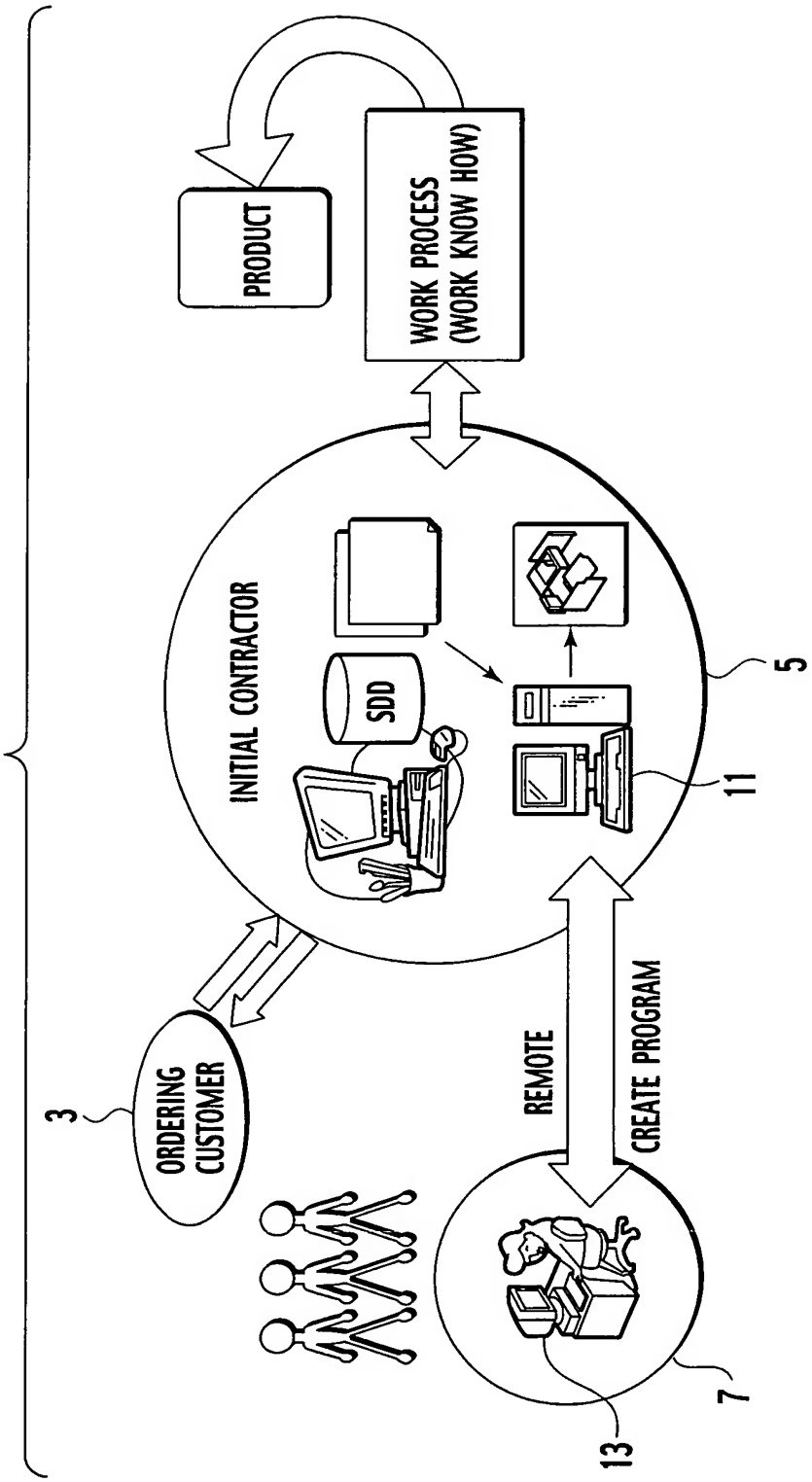

PRODUCT
WORK PROCESS
(WORK KNOW HOW)
INITIAL CONTRACTOR
SDD
5
11
3
ORDERING
CUSTOMER
REMOTE
CREATE PROGRAM
7
13

FIG.3

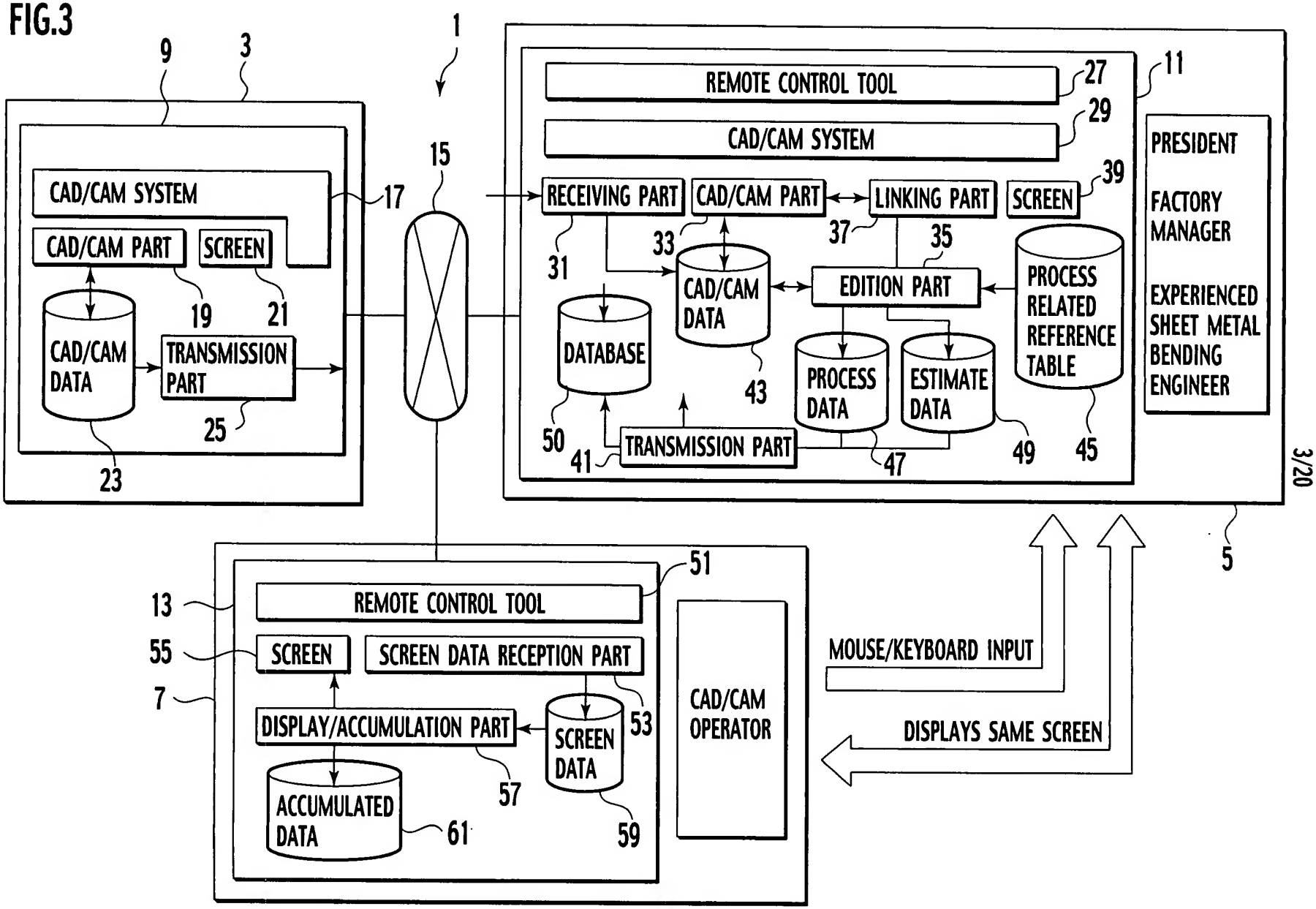

1
9
3
15
CAD/CAM SYSTEM
17
CAD/CAM PART
SCREEN
19
21
CAD/CAM DATA
TRANSMISSION PART
25
23
REMOTE CONTROL TOOL
27
CAD/CAM SYSTEM
29
11
PRESIDENT
FACTORY MANAGER
EXPERIENCED SHEET METAL BENDING ENGINEER
RECEIVING PART
CAD/CAM PART
LINKING PART
SCREEN
39
31
33
37
35
CAD/CAM DATA
EDITION PART
PROCESS RELATED REFERENCE TABLE
DATABASE
43
PROCESS DATA
ESTIMATE DATA
50
41
TRANSMISSION PART
47
49
45
3/20
5
13
51
REMOTE CONTROL TOOL
55
SCREEN
SCREEN DATA RECEPTION PART
7
53
DISPLAY/ACCUMULATION PART
SCREEN DATA
57
ACCUMULATED DATA
61
59
CAD/CAM OPERATOR
MOUSE/KEYBOARD INPUT
DISPLAYS SAME SCREEN

FIG.4

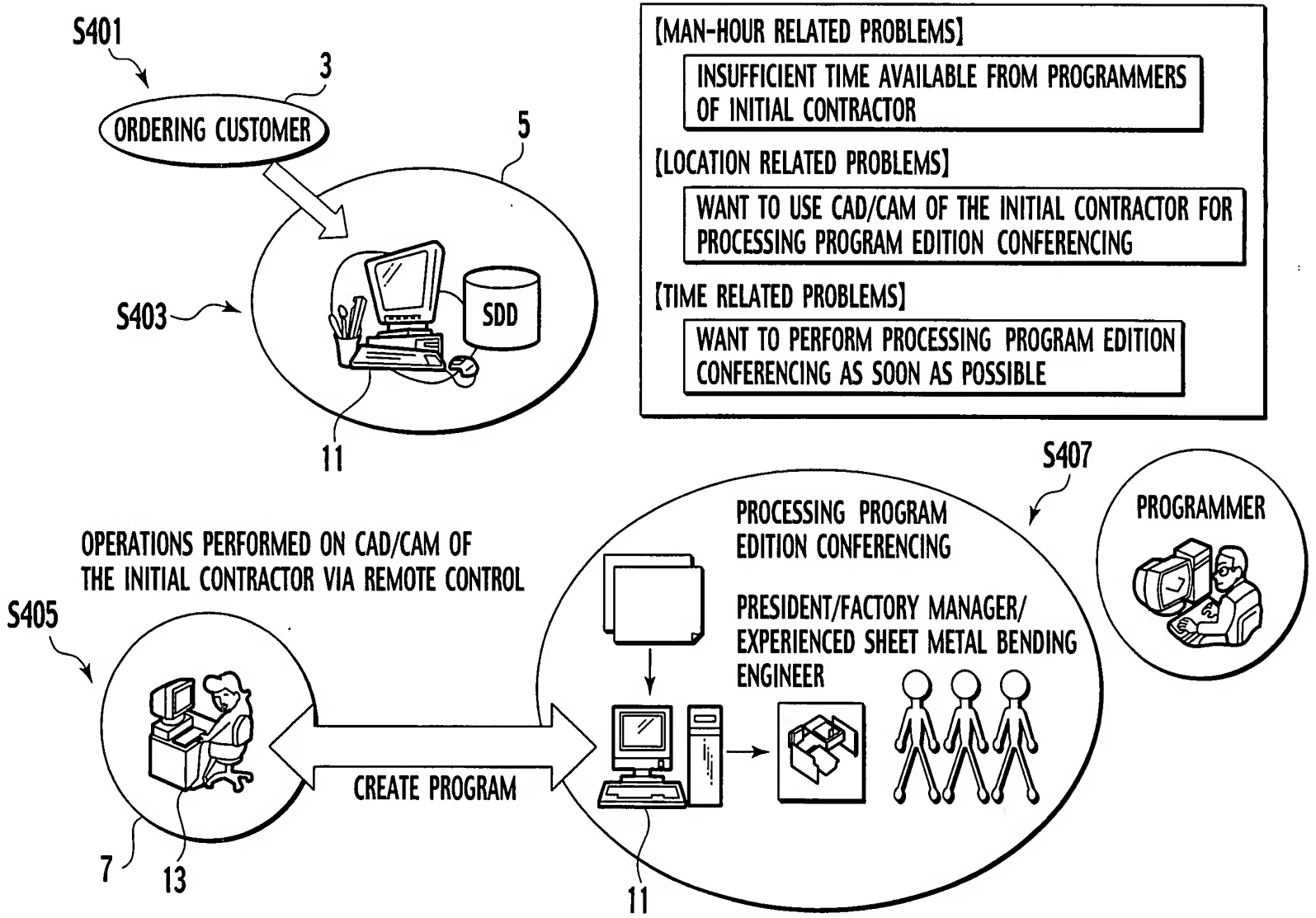

S401
3
ORDERING CUSTOMER
5
S403
SDD
11
[MAN-HOUR RELATED PROBLEMS]
INSUFFICIENT TIME AVAILABLE FROM PROGRAMMERS OF INITIAL CONTRACTOR
[LOCATION RELATED PROBLEMS]
WANT TO USE CAD/CAM OF THE INITIAL CONTRACTOR FOR PROCESSING PROGRAM EDITION CONFERENCING
[TIME RELATED PROBLEMS]
WANT TO PERFORM PROCESSING PROGRAM EDITION CONFERENCING AS SOON AS POSSIBLE
S407
PROGRAMMER
PROCESSING PROGRAM EDITION CONFERENCING
PRESIDENT/FACTORY MANAGER/ EXPERIENCED SHEET METAL BENDING ENGINEER
OPERATIONS PERFORMED ON CAD/CAM OF THE INITIAL CONTRACTOR VIA REMOTE CONTROL
S405
CREATE PROGRAM
7
13
11

FIG.5

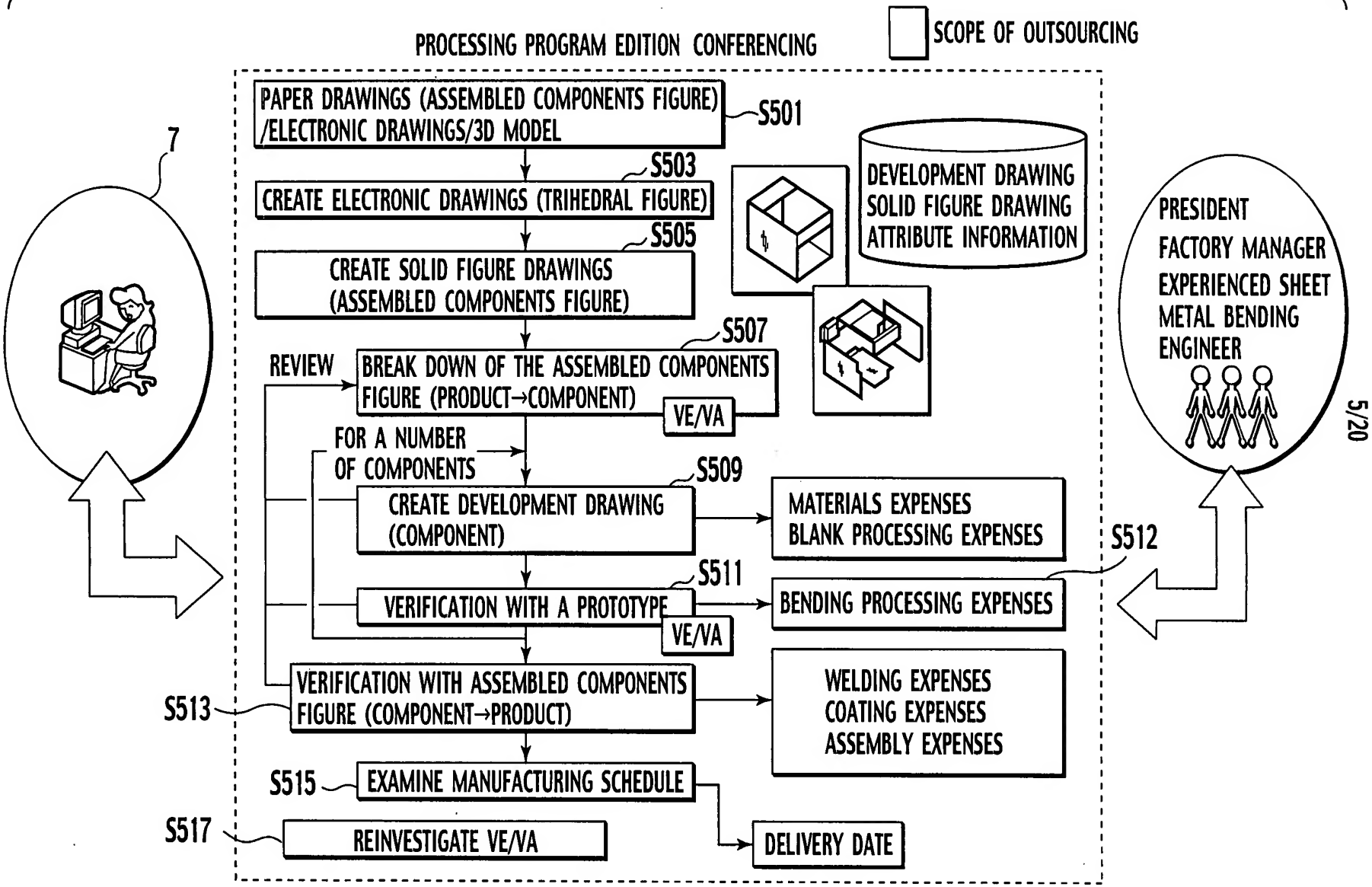

PROCESSING PROGRAM EDITION CONFERENCING
SCOPE OF OUTSOURCING
7
PAPER DRAWINGS (ASSEMBLED COMPONENTS FIGURE) /ELECTRONIC DRAWINGS/3D MODEL
S501
S503
CREATE ELECTRONIC DRAWINGS (TRIHEDRAL FIGURE)
S505
CREATE SOLID FIGURE DRAWINGS (ASSEMBLED COMPONENTS FIGURE)
DEVELOPMENT DRAWING SOLID FIGURE DRAWING ATTRIBUTE INFORMATION
S507
REVIEW
BREAK DOWN OF THE ASSEMBLED COMPONENTS FIGURE (PRODUCT→COMPONENT)
VE/VA
FOR A NUMBER OF COMPONENTS
S509
CREATE DEVELOPMENT DRAWING (COMPONENT)
MATERIALS EXPENSES
BLANK PROCESSING EXPENSES
S512
S511
VERIFICATION WITH A PROTOTYPE
VE/VA
BENDING PROCESSING EXPENSES
S513
VERIFICATION WITH ASSEMBLED COMPONENTS FIGURE (COMPONENT→PRODUCT)
WELDING EXPENSES
COATING EXPENSES
ASSEMBLY EXPENSES
S515
EXAMINE MANUFACTURING SCHEDULE
S517
REINVESTIGATE VE/VA
DELIVERY DATE
PRESIDENT
FACTORY MANAGER
EXPERIENCED SHEET METAL BENDING ENGINEER
5/20

FIG.6

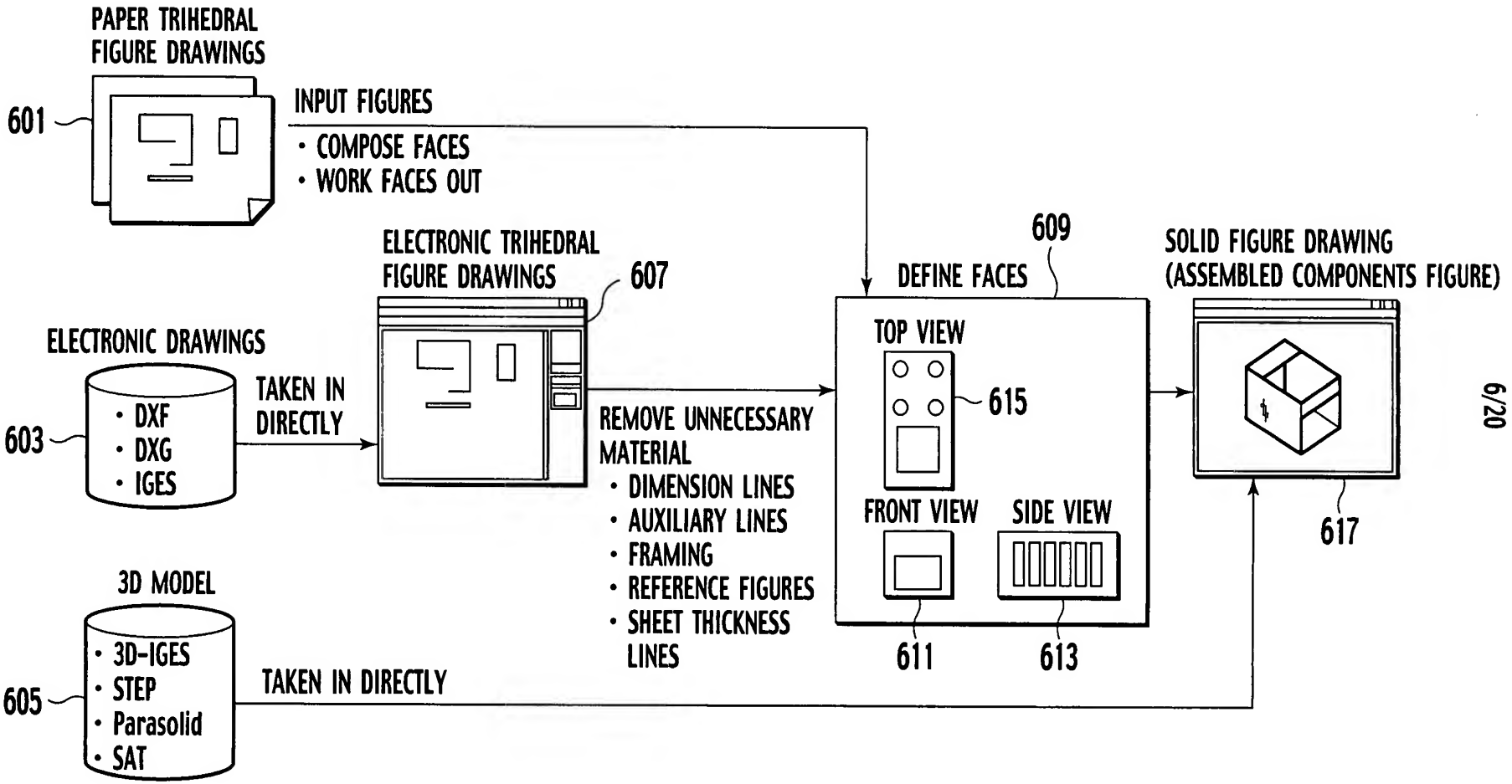

PAPER TRIHEDRAL FIGURE DRAWINGS
601
INPUT FIGURES
• COMPOSE FACES
• WORK FACES OUT
ELECTRONIC TRIHEDRAL FIGURE DRAWINGS
607
609
DEFINE FACES
SOLID FIGURE DRAWING (ASSEMBLED COMPONENTS FIGURE)
ELECTRONIC DRAWINGS
603
• DXF
• DXG
• IGES
TAKEN IN DIRECTLY
REMOVE UNNECESSARY MATERIAL
• DIMENSION LINES
• AUXILIARY LINES
• FRAMING
• REFERENCE FIGURES
• SHEET THICKNESS LINES
TOP VIEW
615
FRONT VIEW
SIDE VIEW
611
613
617
3D MODEL
605
• 3D-IGES
• STEP
• Parasolid
• SAT
TAKEN IN DIRECTLY

FIG.7

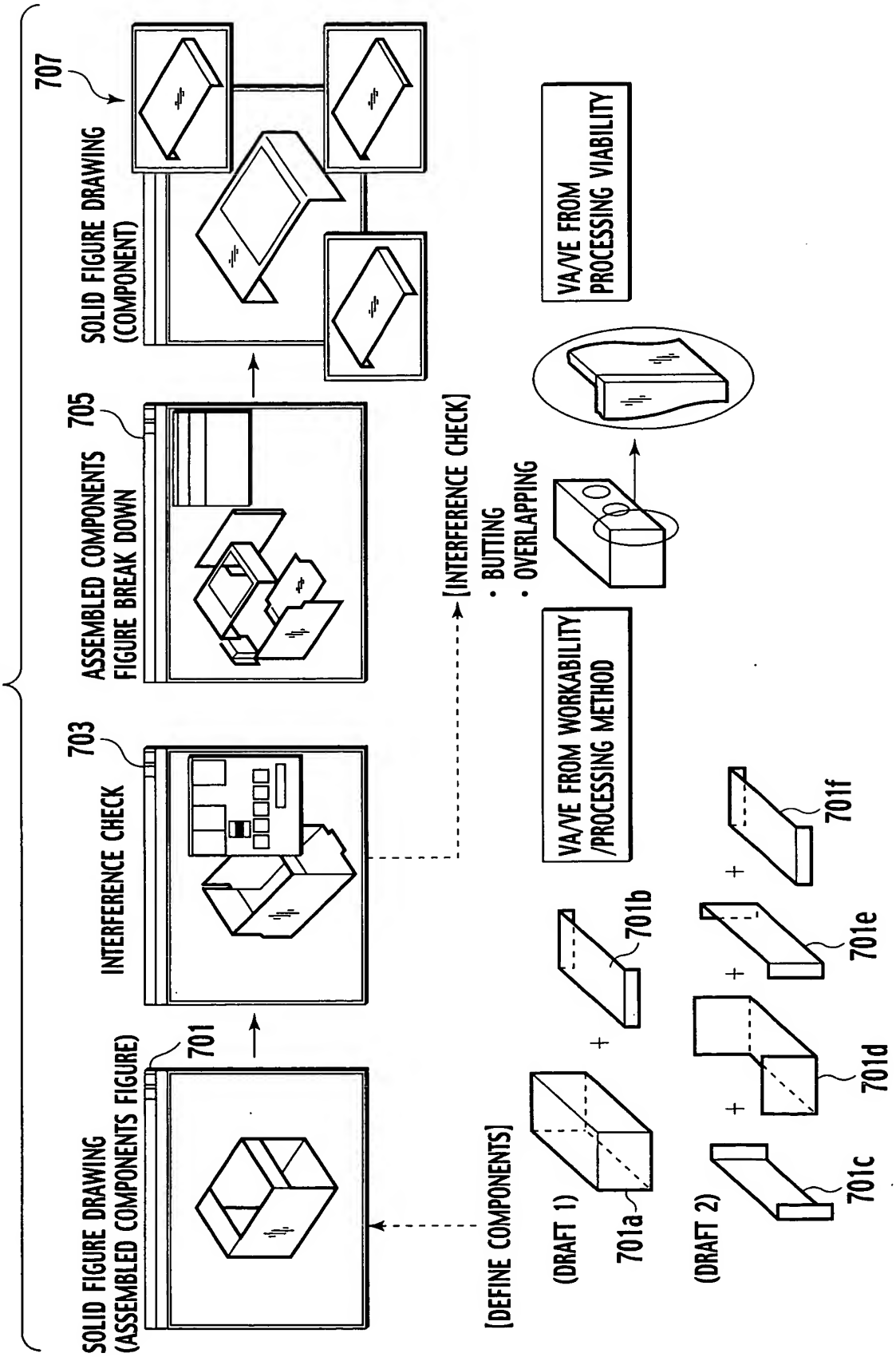
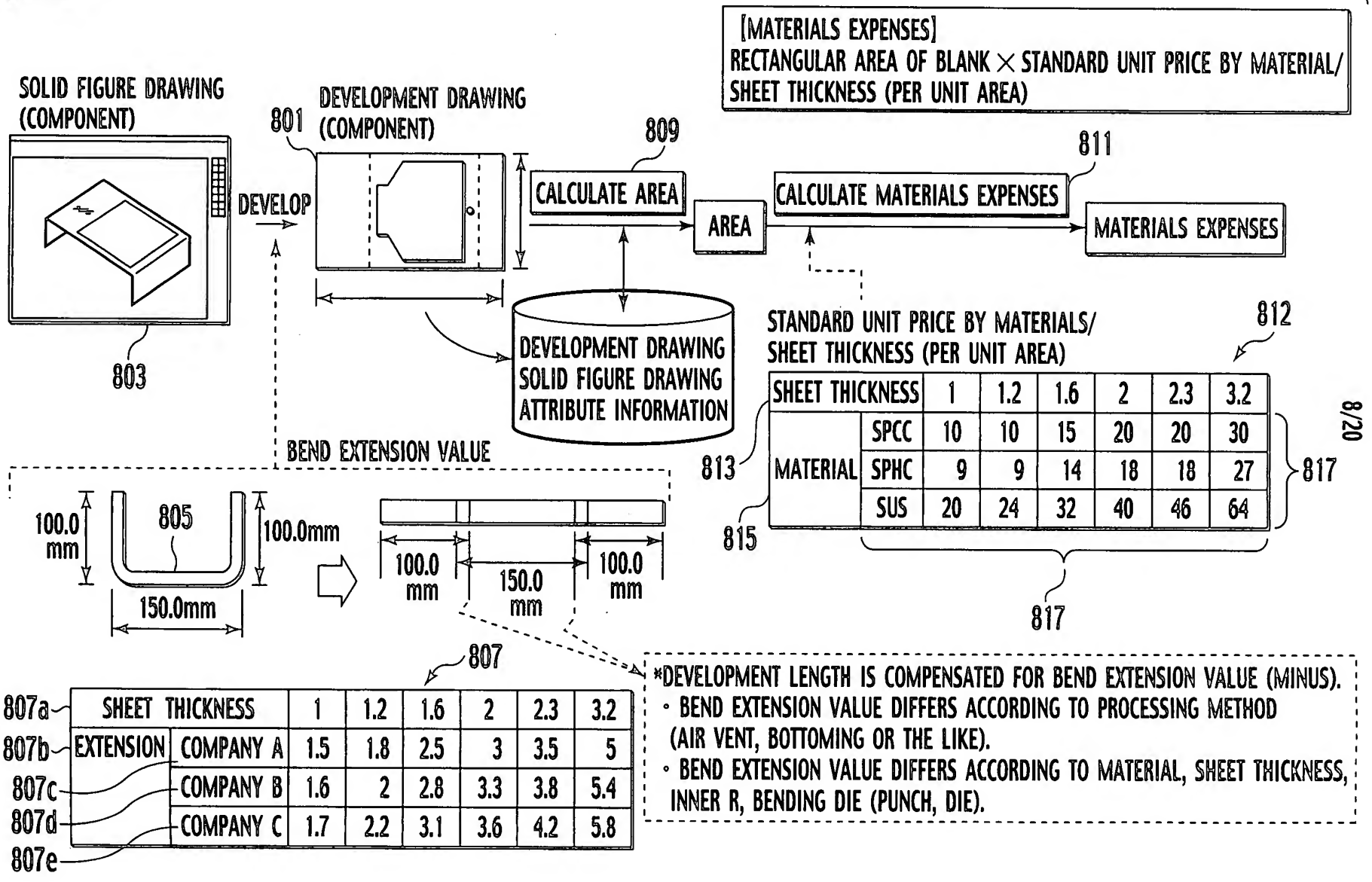

SOLID FIGURE DRAWING
(ASSEMBLED COMPONENTS FIGURE)
701
INTERFERENCE CHECK
703
ASSEMBLED COMPONENTS
FIGURE BREAK DOWN
705
SOLID FIGURE DRAWING
(COMPONENT)
707
[DEFINE COMPONENTS]
[INTERFERENCE CHECK]
• BUTTING
• OVERLAPPING
VA/VE FROM WORKABILITY
/PROCESSING METHOD
VA/VE FROM
PROCESSING VIABILITY
(DRAFT 1)
701a
701b
(DRAFT 2)
701c
701d
701e
701f

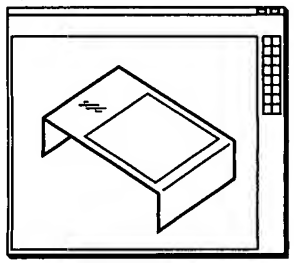
FIG.8

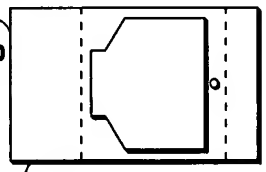


SHEET THICKNESS		1	1.2	1.6	2	2.3	3.2
MATERIAL	SPCC	10	10	15	20	20	30
	SPHC	9	9	14	18	18	27
	SUS	20	24	32	40	46	64

SHEET THICKNESS		1	1.2	1.6	2	2.3	3.2
EXTENSION	COMPANY A	1.5	1.8	2.5	3	3.5	5
	COMPANY B	1.6	2	2.8	3.3	3.8	5.4
	COMPANY C	1.7	2.2	3.1	3.6	4.2	5.8

FIG.9





BEND EXTENSION VALUE

DEVELOPMENT DRAWING
SOLID FIGURE DRAWING
ATTRIBUTE INFORMATION

950 [BLANK PROCESSING EXPENSES] ・・ TABLE OF STANDARD UNIT PRICES DIFFERS FOR DIFFERENT MATERIALS/SHEET THICKNESSES

・ SHEARING (CUTTING OF MATERIALS) PROCESSING EXPENSES ~ 903a, 909a
= RECTANGULAR AREA OF BLANK × STANDARD UNIT PRICE FOR CUTTING (PER UNIT AREA)
913a 913b

・ TURRET PUNCH PROCESSING EXPENSES ~ 903b
= Σ (PROCESSING TIME BY FORM PROCESSED) × STANDARD UNIT PRICE FOR TURRET PUNCH (PER UNIT TIME)
915a 907 917a 915b

・ TURRET PUNCH SET UP EXPENSES = NUMBER OF DIES USED × TIME REQUIRED FOR CHANGING DIFFERENT DIE SIZES × UNIT PRICE (PER UNIT TIME) 919b

・ LASER PROCESSING EXPENSES ~ 909b 919a 917b
= Σ (PROCESSING TIME BY FORM PROCESSED) × STANDARD UNIT PRICE FOR LASER (PER UNIT TIME)

・ TAPPING PROCESSING EXPENSES ~ 903c, 909c
= Σ (PROCESSING TIME BY TAPPING HOLE DIAMETER) × STANDARD UNIT PRICE FOR TAPPING (PER UNIT TIME)
921a 921b

・ DEBURRING PROCESSING EXPENSES ~ 903d, 909d
= Σ (PROCESSING TIME BY FORM PROCESSED) × STANDARD PRICE FOR DEBURRING (PER UNIT TIME)
923a 923b

9/20

903

[FOR TURRET PUNCH PRESS PROCESSING]

BLANK PROCESSING EXPENSES × NUMBER OF SHEETS PROCESSED + TURRET PUNCH PRESS SET UP EXPENSES
905 907

- SHEARING PROCESSING EXPENSES ~ 903a
- TURRET PUNCH PRESS PROCESSING EXPENSES ~ 903b
- TAPPING PROCESSING EXPENSES ~ 903c
- DEBURRING PROCESSING EXPENSES ~ 903d

[FOR LASER PROCESSING]

BLANK PROCESSING EXPENSES × NUMBER OF SHEETS PROCESSED
909 911

- SHEARING PROCESSING EXPENSES ~ 909a
- LASER PROCESSING EXPENSES ~ 909b
- TAPPING PROCESSING EXPENSES ~ 909c
- DEBURRING PROCESSING EXPENSES ~ 909d

FIG.10

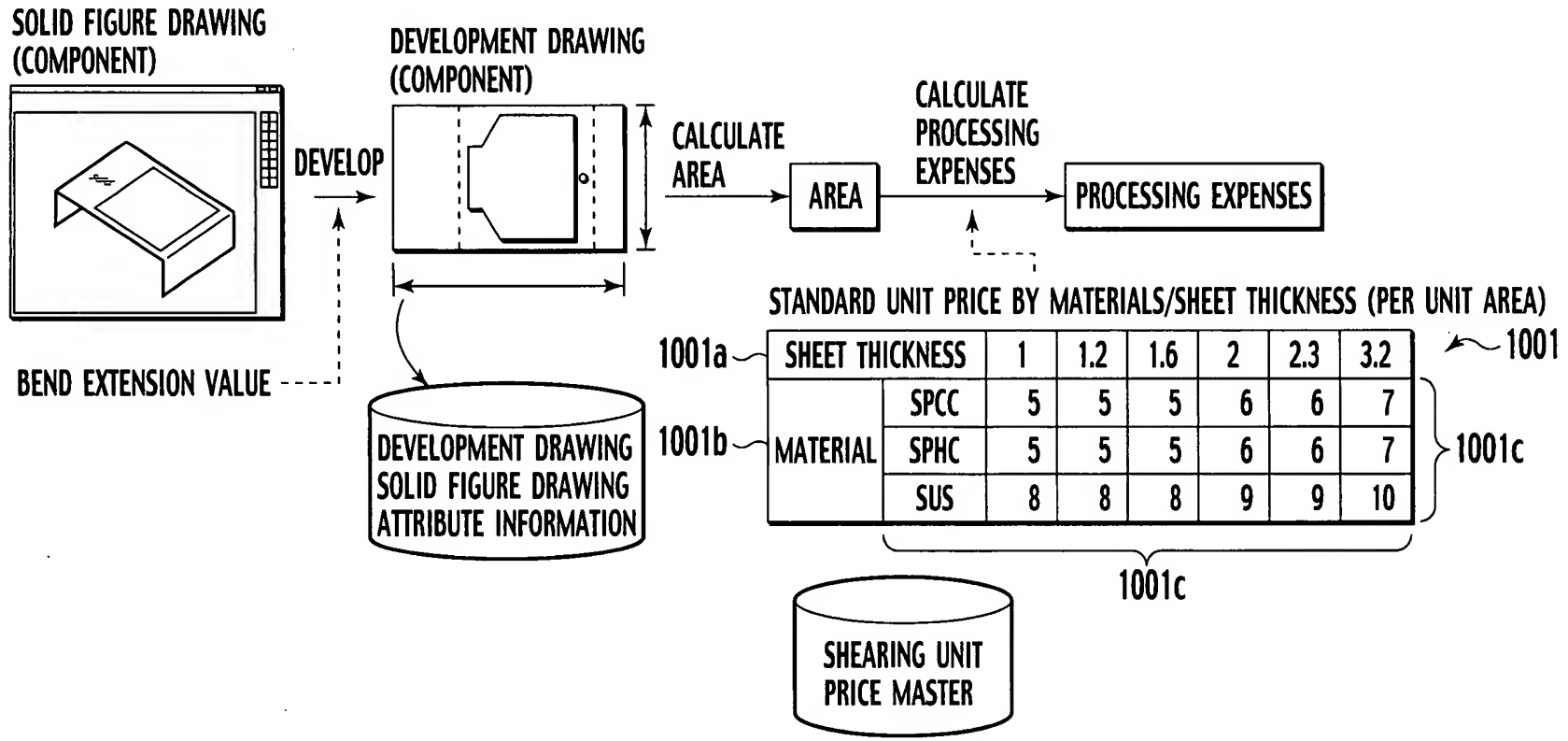
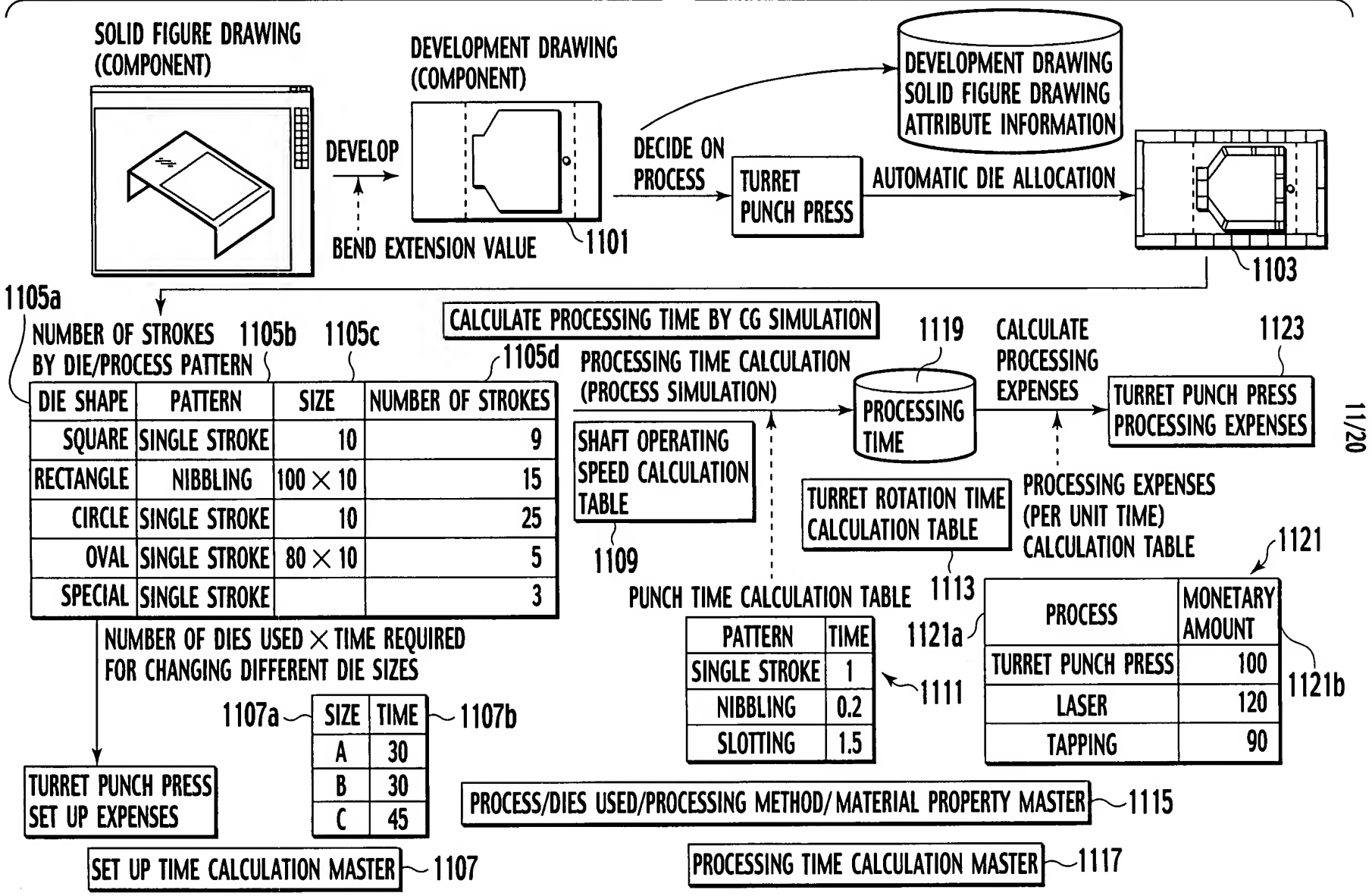

SOLID FIGURE DRAWING (COMPONENT)
DEVELOPMENT DRAWING (COMPONENT)
DEVELOP
CALCULATE AREA
AREA
CALCULATE PROCESSING EXPENSES
PROCESSING EXPENSES
BEND EXTENSION VALUE
DEVELOPMENT DRAWING SOLID FIGURE DRAWING ATTRIBUTE INFORMATION
STANDARD UNIT PRICE BY MATERIALS/SHEET THICKNESS (PER UNIT AREA)
1001
1001a
1001b
1001c
SHEET THICKNESS
MATERIAL
SPCC
SPHC
SUS
1 1.2 1.6 2 2.3 3.2
5 5 5 6 6 7
5 5 5 6 6 7
8 8 8 9 9 10
SHEARING UNIT PRICE MASTER

FIG.11



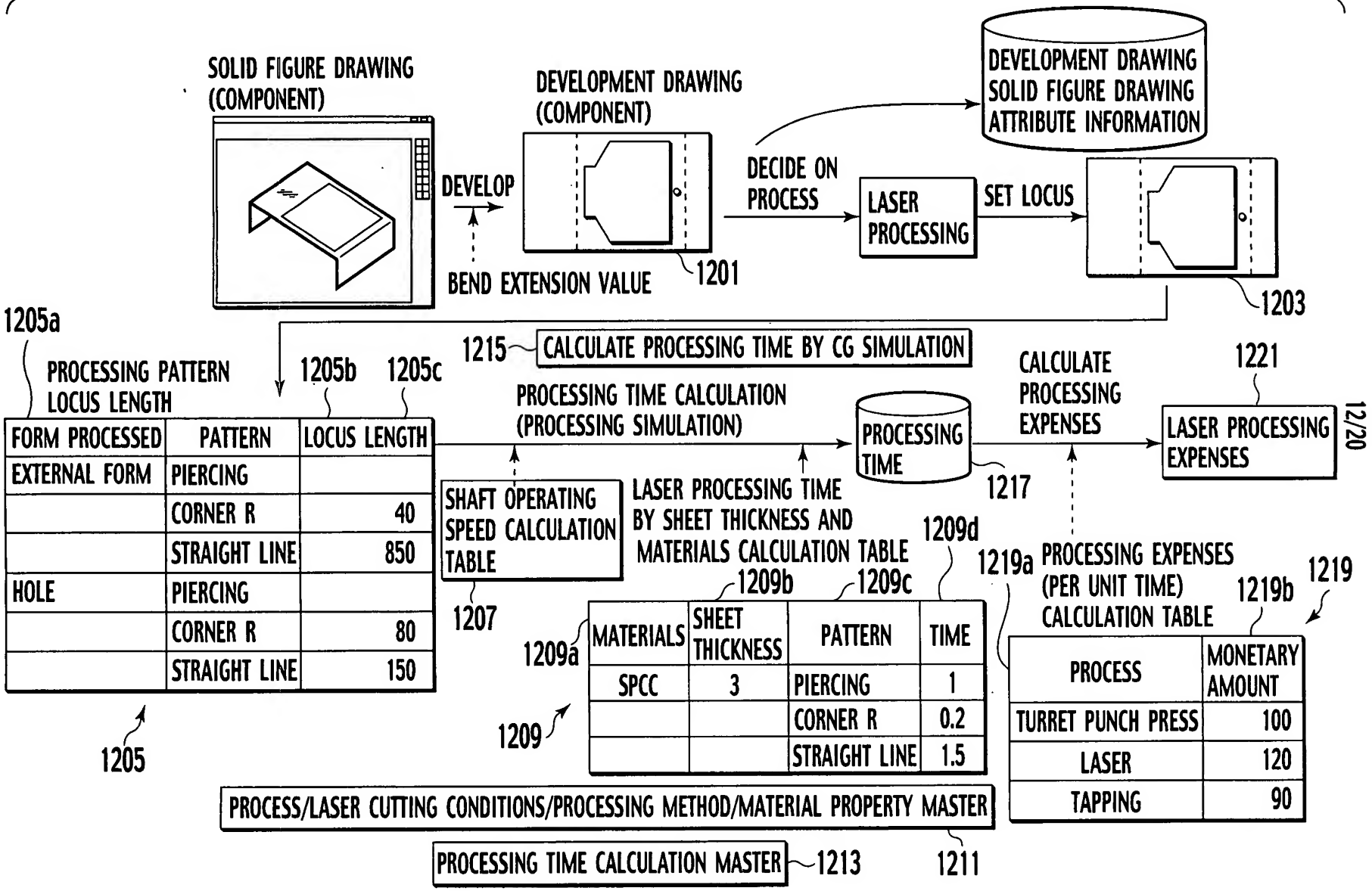
DIE SHAPE	PATTERN	SIZE	NUMBER OF STROKES
SQUARE	SINGLE STROKE	10	9
RECTANGLE	NIBBLING	100 × 10	15
CIRCLE	SINGLE STROKE	10	25
OVAL	SINGLE STROKE	80 × 10	5
SPECIAL	SINGLE STROKE		3

PATTERN	TIME
SINGLE STROKE	1
NIBBLING	0.2
SLOTTING	1.5

PROCESS	MONETARY AMOUNT
TURRET PUNCH PRESS	100
LASER	120
TAPPING	90

SIZE	TIME
A	30
B	30
C	45

FIG.12



FORM PROCESSED	PATTERN	LOCUS LENGTH
EXTERNAL FORM	PIERCING	
	CORNER R	40
	STRAIGHT LINE	850
HOLE	PIERCING	
	CORNER R	80
	STRAIGHT LINE	150

MATERIALS	SHEET THICKNESS	PATTERN	TIME
SPCC	3	PIERCING	1
		CORNER R	0.2
		STRAIGHT LINE	1.5

PROCESS	MONETARY AMOUNT
TURRET PUNCH PRESS	100
LASER	120
TAPPING	90

FIG.13

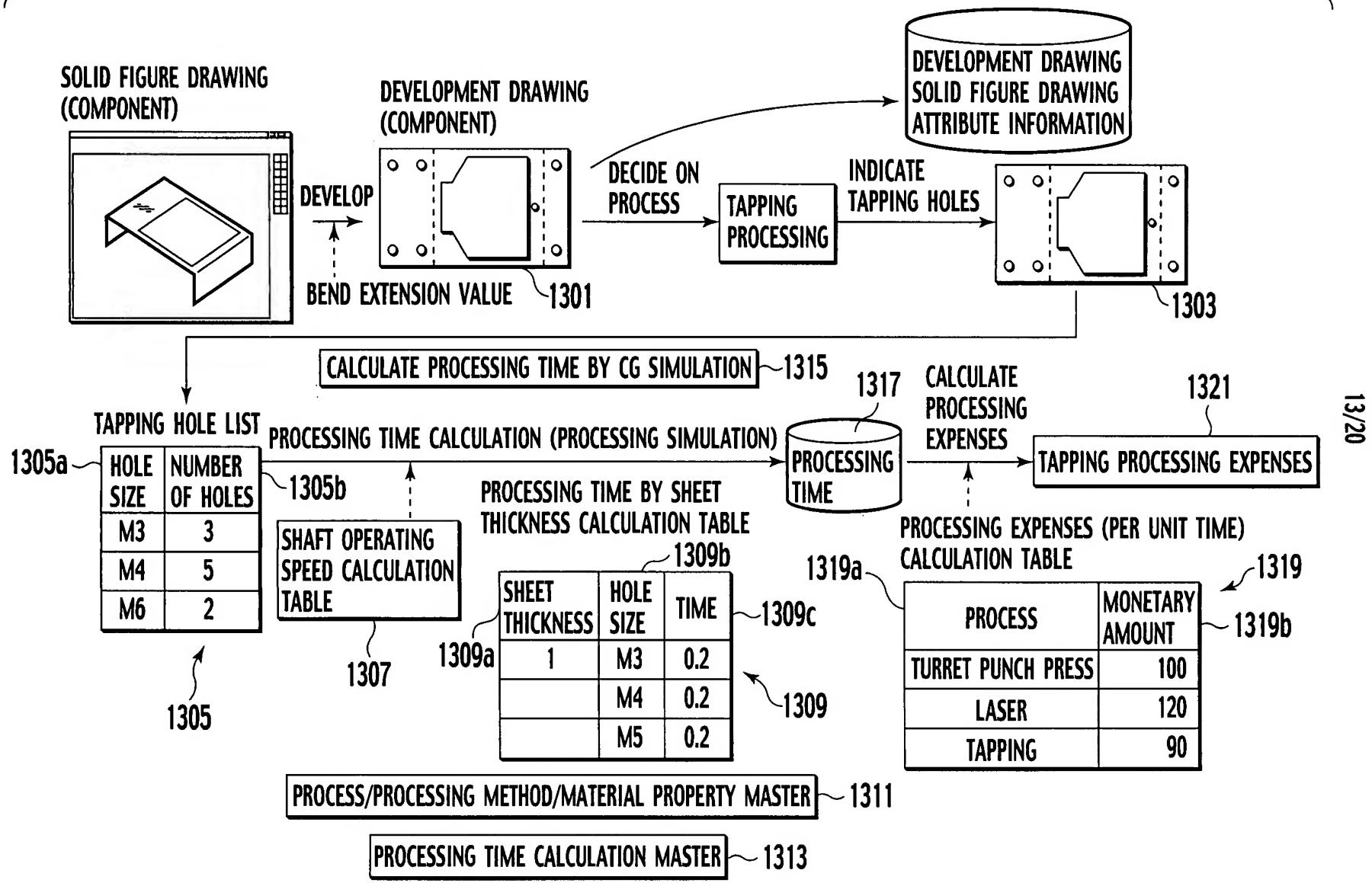

SOLID FIGURE DRAWING (COMPONENT)
DEVELOPMENT DRAWING (COMPONENT)
DEVELOP
BEND EXTENSION VALUE
1301
DECIDE ON PROCESS
TAPPING PROCESSING
INDICATE TAPPING HOLES
1303
DEVELOPMENT DRAWING
SOLID FIGURE DRAWING
ATTRIBUTE INFORMATION
CALCULATE PROCESSING TIME BY CG SIMULATION
1315
TAPPING HOLE LIST
1305a
HOLE SIZE
NUMBER OF HOLES
M3 3
M4 5
M6 2
1305b
1305
PROCESSING TIME CALCULATION (PROCESSING SIMULATION)
SHAFT OPERATING SPEED CALCULATION TABLE
1307
PROCESSING TIME BY SHEET THICKNESS CALCULATION TABLE
1309b
SHEET THICKNESS
HOLE SIZE
TIME
1309a
1 M3 0.2
M4 0.2
M5 0.2
1309c
1309
1317
PROCESSING TIME
CALCULATE PROCESSING EXPENSES
1321
TAPPING PROCESSING EXPENSES
PROCESSING EXPENSES (PER UNIT TIME) CALCULATION TABLE
1319a
1319
PROCESS
MONETARY AMOUNT
1319b
TURRET PUNCH PRESS 100
LASER 120
TAPPING 90
PROCESS/PROCESSING METHOD/MATERIAL PROPERTY MASTER
1311
PROCESSING TIME CALCULATION MASTER
1313

FIG.14

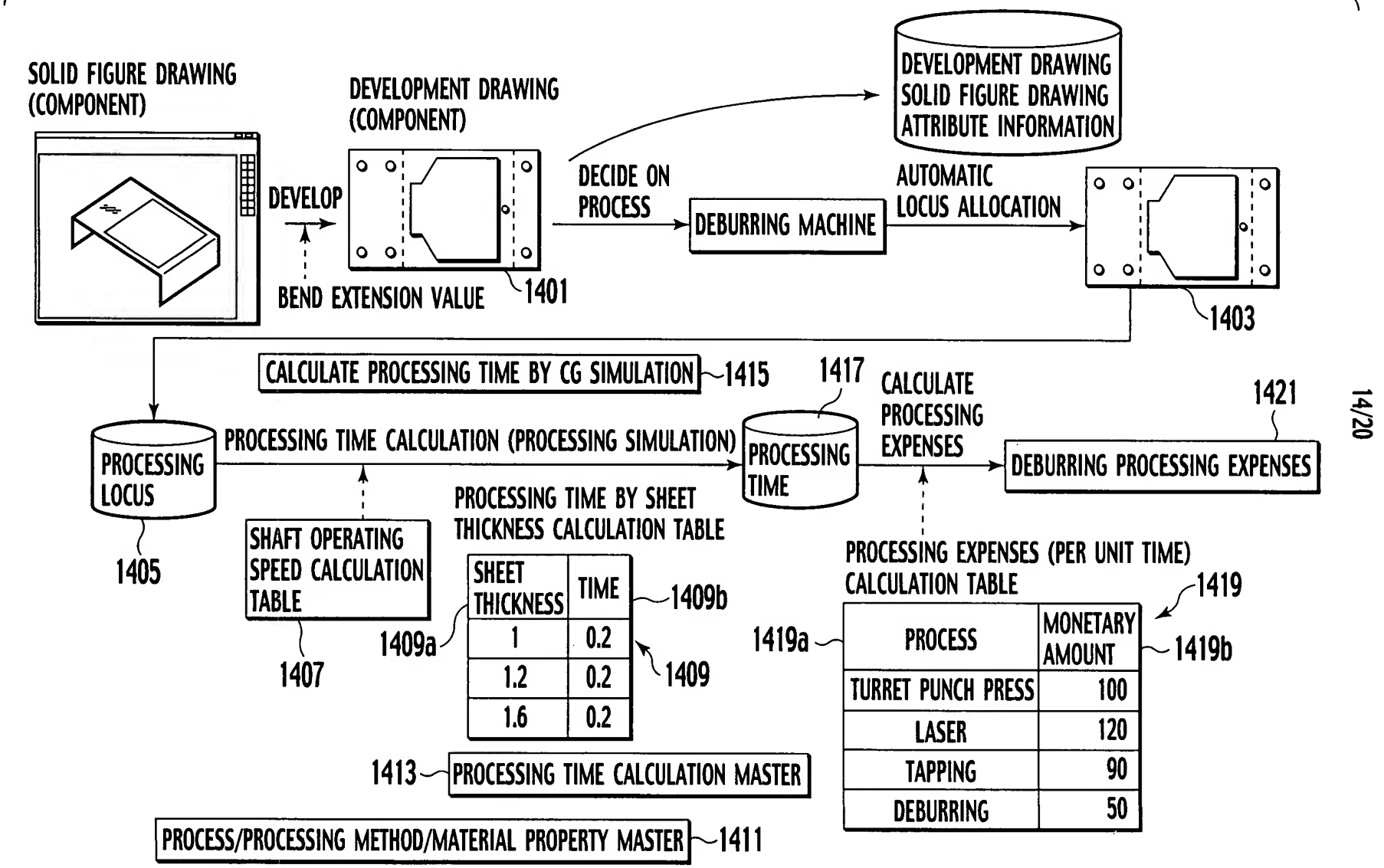
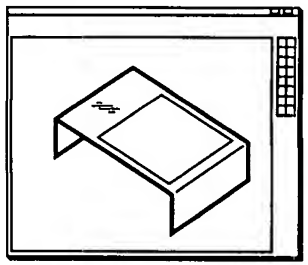

SOLID FIGURE DRAWING (COMPONENT)
DEVELOPMENT DRAWING (COMPONENT)
DEVELOP
BEND EXTENSION VALUE
1401
DECIDE ON PROCESS
DEBURRING MACHINE
DEVELOPMENT DRAWING SOLID FIGURE DRAWING ATTRIBUTE INFORMATION
AUTOMATIC LOCUS ALLOCATION
1403
CALCULATE PROCESSING TIME BY CG SIMULATION
1415
1417
CALCULATE PROCESSING EXPENSES
1421
DEBURRING PROCESSING EXPENSES
PROCESSING LOCUS
1405
PROCESSING TIME CALCULATION (PROCESSING SIMULATION)
PROCESSING TIME
SHAFT OPERATING SPEED CALCULATION TABLE
1407
PROCESSING TIME BY SHEET THICKNESS CALCULATION TABLE
SHEET THICKNESS
TIME
1409b
1409a
1
0.2
1.2
0.2
1.6
0.2
1409
PROCESSING EXPENSES (PER UNIT TIME) CALCULATION TABLE
1419
1419a
PROCESS
MONETARY AMOUNT
1419b
TURRET PUNCH PRESS
100
LASER
120
TAPPING
90
DEBURRING
50
1413
PROCESSING TIME CALCULATION MASTER
PROCESS/PROCESSING METHOD/MATERIAL PROPERTY MASTER
1411

FIG.15

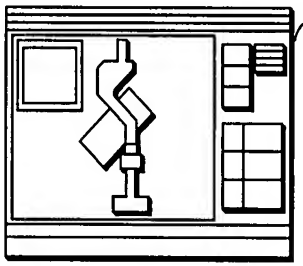


SOLID FIGURE DRAWING (COMPONENT)

DEVELOP

DEVELOPMENT DRAWING (COMPONENT) 1501

BEND EXTENSION VALUE



PROTOTYPE VERIFICATION (BEND CAM) 1503

VA/VE FROM PROCESSING VIABILITY 1503a

VA/VE FROM WORKABILITY AND PROCESSING METHOD 1503b

[BENDING PROCESSING EXPENSES] ··TABLE OF STANDARD UNIT PRICES DIFFERS FOR DIFFERENT MATERIALS/SHEET THICKNESSES

1513a 1513b

- BENDING PROCESSING EXPENSES = Σ(PROCESSING TIME BY BEND FORM) × STANDARD UNIT PRICE FOR BENDING (PER UNIT TIME) 1505
- BENDING SET UP EXPENSES = NUMBER OF DIES USED × TIME REQUIRED FOR CHANGING DIES 1515a 1515b 1509
- SPECIAL DIE PURCHASING EXPENSES (WHEN SPECIAL DIE REQUIRED) 1511

1505 1507 1509 1511

BENDING PROCESSING EXPENSES × NUMBER OF SHEETS PROCESSED + BENDING SET UP EXPENSES + SPECIAL DIE PURCHASING EXPENSES

FIG.16

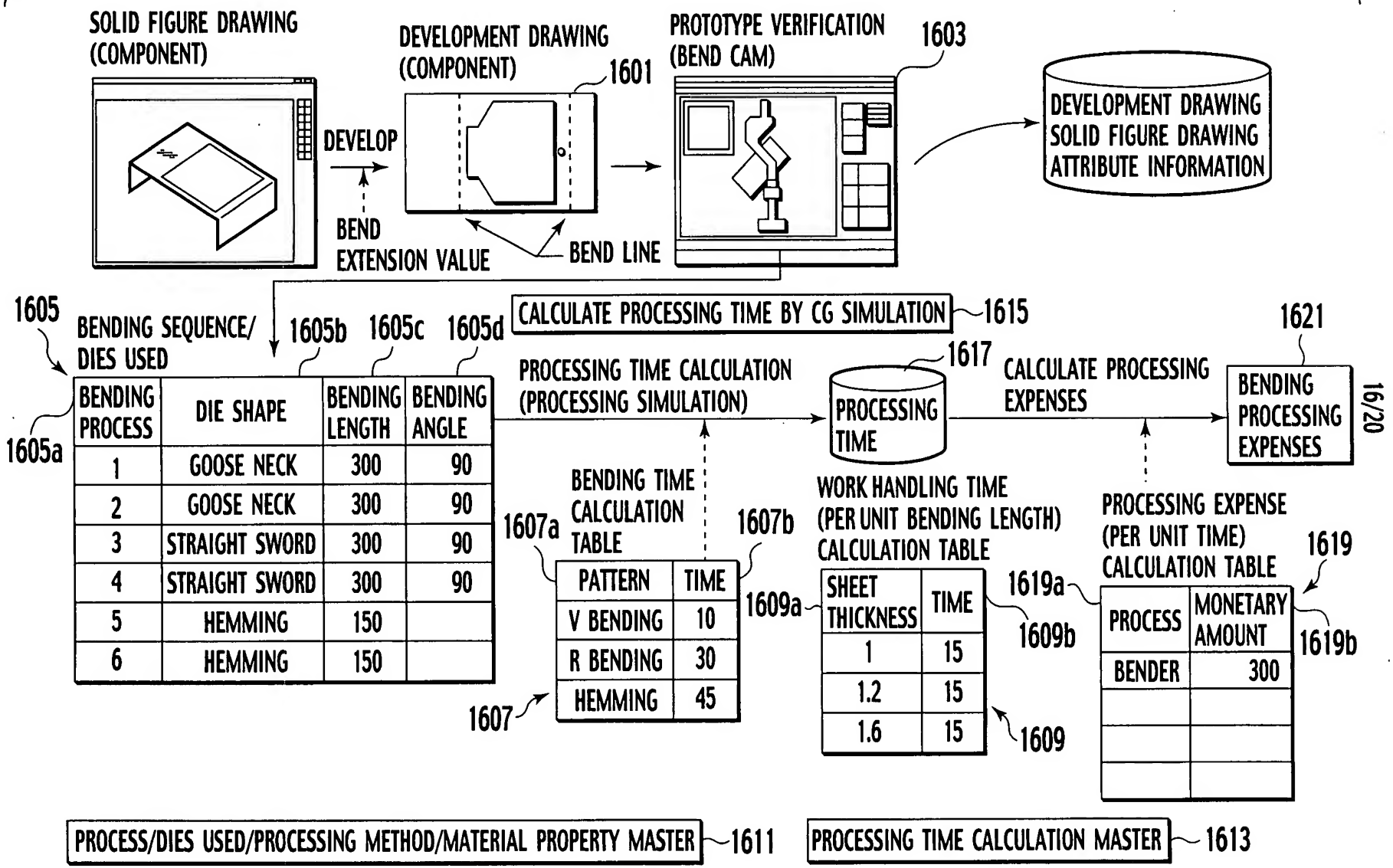

SOLID FIGURE DRAWING (COMPONENT)
DEVELOP
DEVELOPMENT DRAWING (COMPONENT)
1601
BEND EXTENSION VALUE
BEND LINE
PROTOTYPE VERIFICATION (BEND CAM)
1603
DEVELOPMENT DRAWING SOLID FIGURE DRAWING ATTRIBUTE INFORMATION
1605
BENDING SEQUENCE/ DIES USED
1605b
1605c
1605d
CALCULATE PROCESSING TIME BY CG SIMULATION
1615
1621
1605a
BENDING PROCESS
DIE SHAPE
BENDING LENGTH
BENDING ANGLE
1 GOOSE NECK 300 90
2 GOOSE NECK 300 90
3 STRAIGHT SWORD 300 90
4 STRAIGHT SWORD 300 90
5 HEMMING 150
6 HEMMING 150
PROCESSING TIME CALCULATION (PROCESSING SIMULATION)
1617
PROCESSING TIME
CALCULATE PROCESSING EXPENSES
BENDING PROCESSING EXPENSES
16/20
BENDING TIME CALCULATION TABLE
1607a
1607b
PATTERN
TIME
V BENDING 10
R BENDING 30
HEMMING 45
1607
WORK HANDLING TIME (PER UNIT BENDING LENGTH) CALCULATION TABLE
1609a
SHEET THICKNESS
TIME
1 15
1.2 15
1.6 15
1609b
1609
PROCESSING EXPENSE (PER UNIT TIME) CALCULATION TABLE
1619
1619a
1619b
PROCESS
MONETARY AMOUNT
BENDER 300
PROCESS/DIES USED/PROCESSING METHOD/MATERIAL PROPERTY MASTER
1611
PROCESSING TIME CALCULATION MASTER
1613

FIG.17

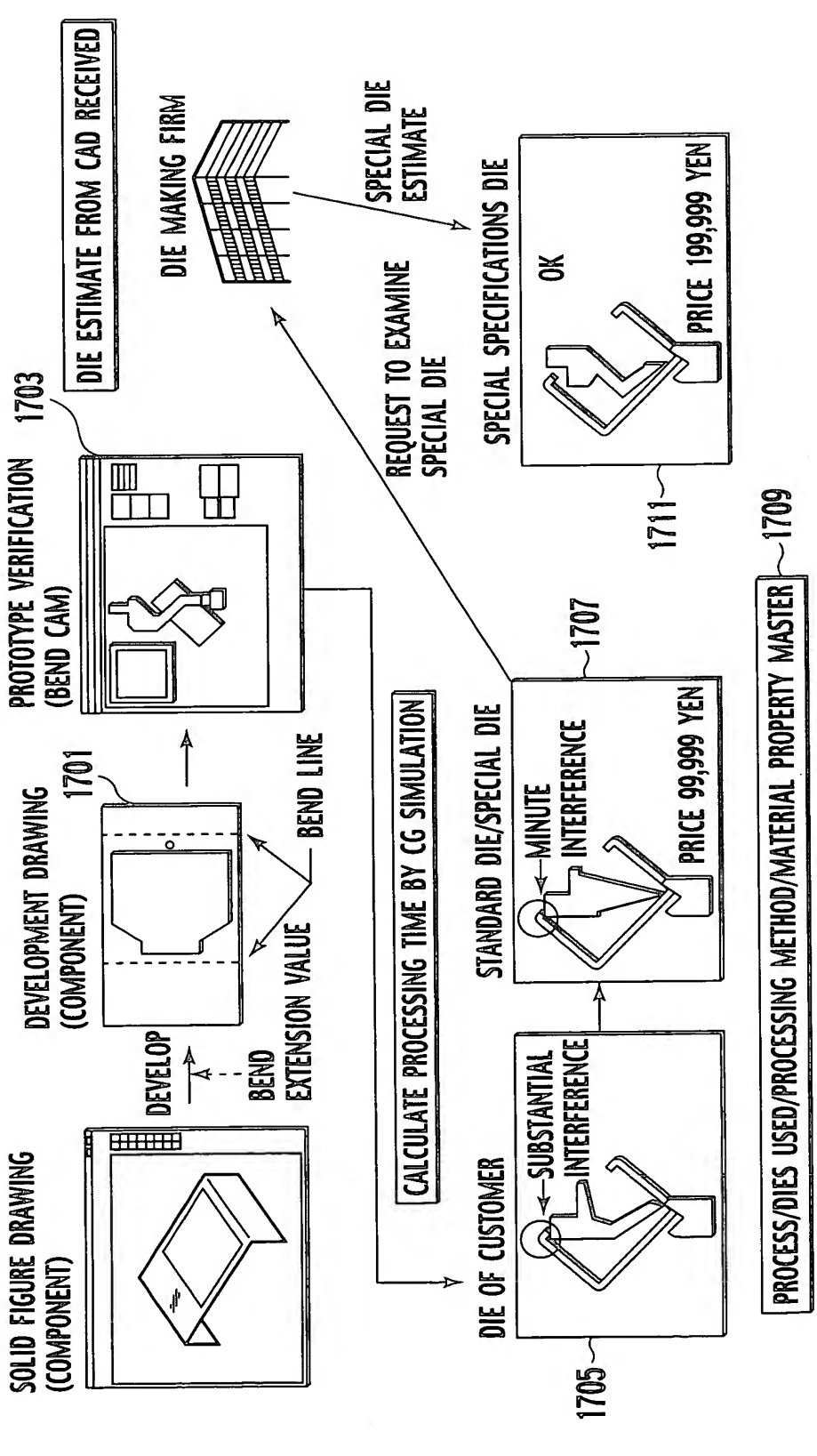

SOLID FIGURE DRAWING (COMPONENT)
DEVELOP
BEND
EXTENSION VALUE
DEVELOPMENT DRAWING (COMPONENT)
1701
BEND LINE
PROTOTYPE VERIFICATION (BEND CAM)
1703
DIE ESTIMATE FROM CAD RECEIVED
DIE MAKING FIRM
SPECIAL DIE ESTIMATE
REQUEST TO EXAMINE SPECIAL DIE
SPECIAL SPECIFICATIONS DIE
OK
PRICE 199,999 YEN
1711
CALCULATE PROCESSING TIME BY CG SIMULATION
STANDARD DIE/SPECIAL DIE
1707
MINUTE INTERFERENCE
PRICE 99,999 YEN
DIE OF CUSTOMER
SUBSTANTIAL INTERFERENCE
1705
PROCESS/DIES USED/PROCESSING METHOD/MATERIAL PROPERTY MASTER
1709

FIG.18

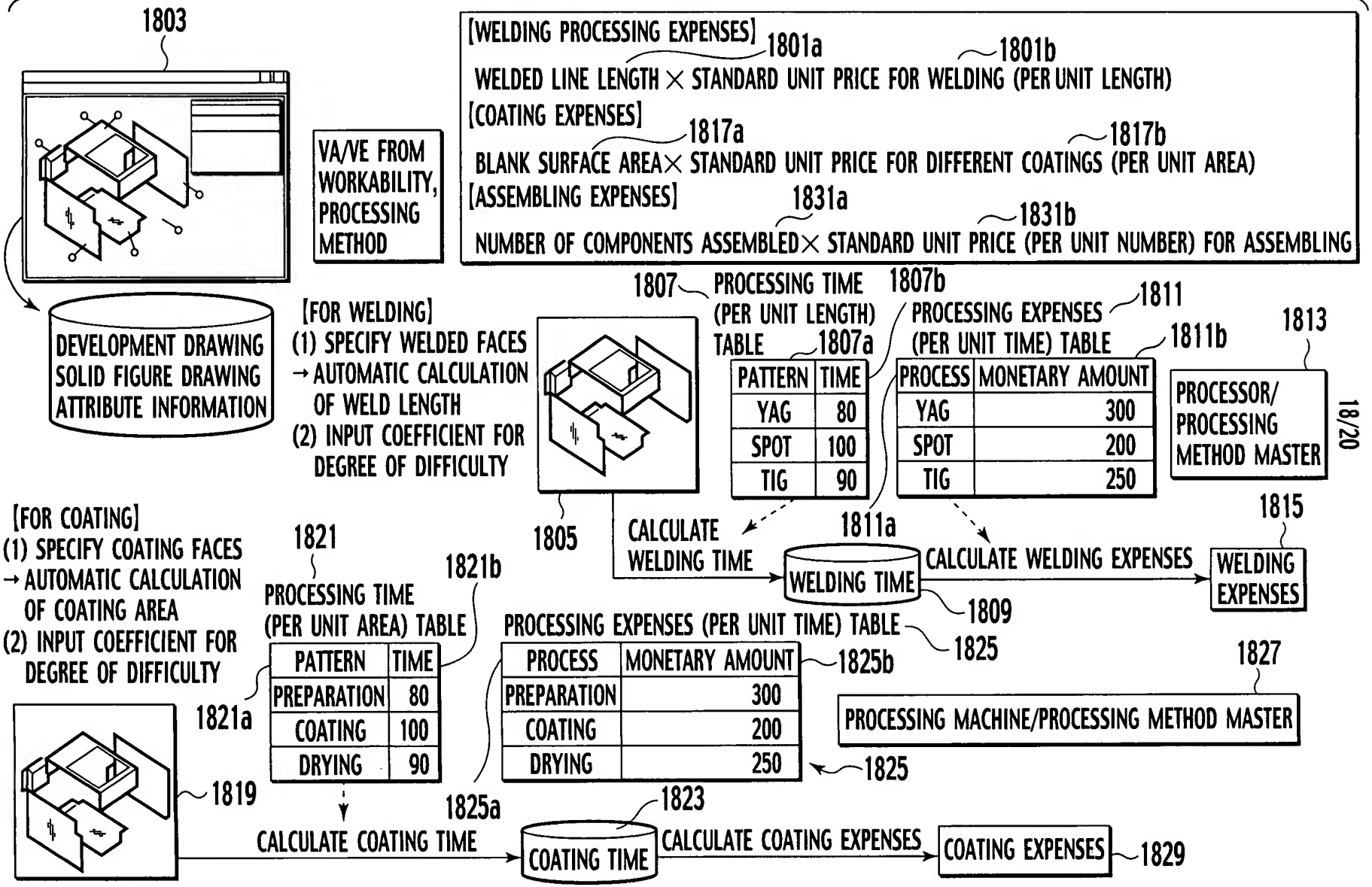

1803
[WELDING PROCESSING EXPENSES]
1801a
1801b
WELDED LINE LENGTH × STANDARD UNIT PRICE FOR WELDING (PER UNIT LENGTH)
[COATING EXPENSES]
1817a
1817b
BLANK SURFACE AREA × STANDARD UNIT PRICE FOR DIFFERENT COATINGS (PER UNIT AREA)
[ASSEMBLING EXPENSES]
1831a
1831b
NUMBER OF COMPONENTS ASSEMBLED × STANDARD UNIT PRICE (PER UNIT NUMBER) FOR ASSEMBLING
VA/VE FROM WORKABILITY, PROCESSING METHOD
DEVELOPMENT DRAWING SOLID FIGURE DRAWING ATTRIBUTE INFORMATION
[FOR WELDING]
(1) SPECIFY WELDED FACES
→ AUTOMATIC CALCULATION OF WELD LENGTH
(2) INPUT COEFFICIENT FOR DEGREE OF DIFFICULTY
1805
1807
PROCESSING TIME (PER UNIT LENGTH) TABLE
1807a
PATTERN | TIME
YAG | 80
SPOT | 100
TIG | 90
1807b
1811
PROCESSING EXPENSES (PER UNIT TIME) TABLE
1811b
PROCESS | MONETARY AMOUNT
YAG | 300
SPOT | 200
TIG | 250
1813
PROCESSOR/ PROCESSING METHOD MASTER
18/20
CALCULATE WELDING TIME
1811a
WELDING TIME
1809
CALCULATE WELDING EXPENSES
1815
WELDING EXPENSES
[FOR COATING]
(1) SPECIFY COATING FACES
→ AUTOMATIC CALCULATION OF COATING AREA
(2) INPUT COEFFICIENT FOR DEGREE OF DIFFICULTY
1821
PROCESSING TIME (PER UNIT AREA) TABLE
1821b
1821a
PATTERN | TIME
PREPARATION | 80
COATING | 100
DRYING | 90
PROCESSING EXPENSES (PER UNIT TIME) TABLE
1825
1825b
PROCESS | MONETARY AMOUNT
PREPARATION | 300
COATING | 200
DRYING | 250
1825
1827
PROCESSING MACHINE/PROCESSING METHOD MASTER
1819
1825a
1823
CALCULATE COATING TIME
COATING TIME
CALCULATE COATING EXPENSES
COATING EXPENSES
1829

FIG.19

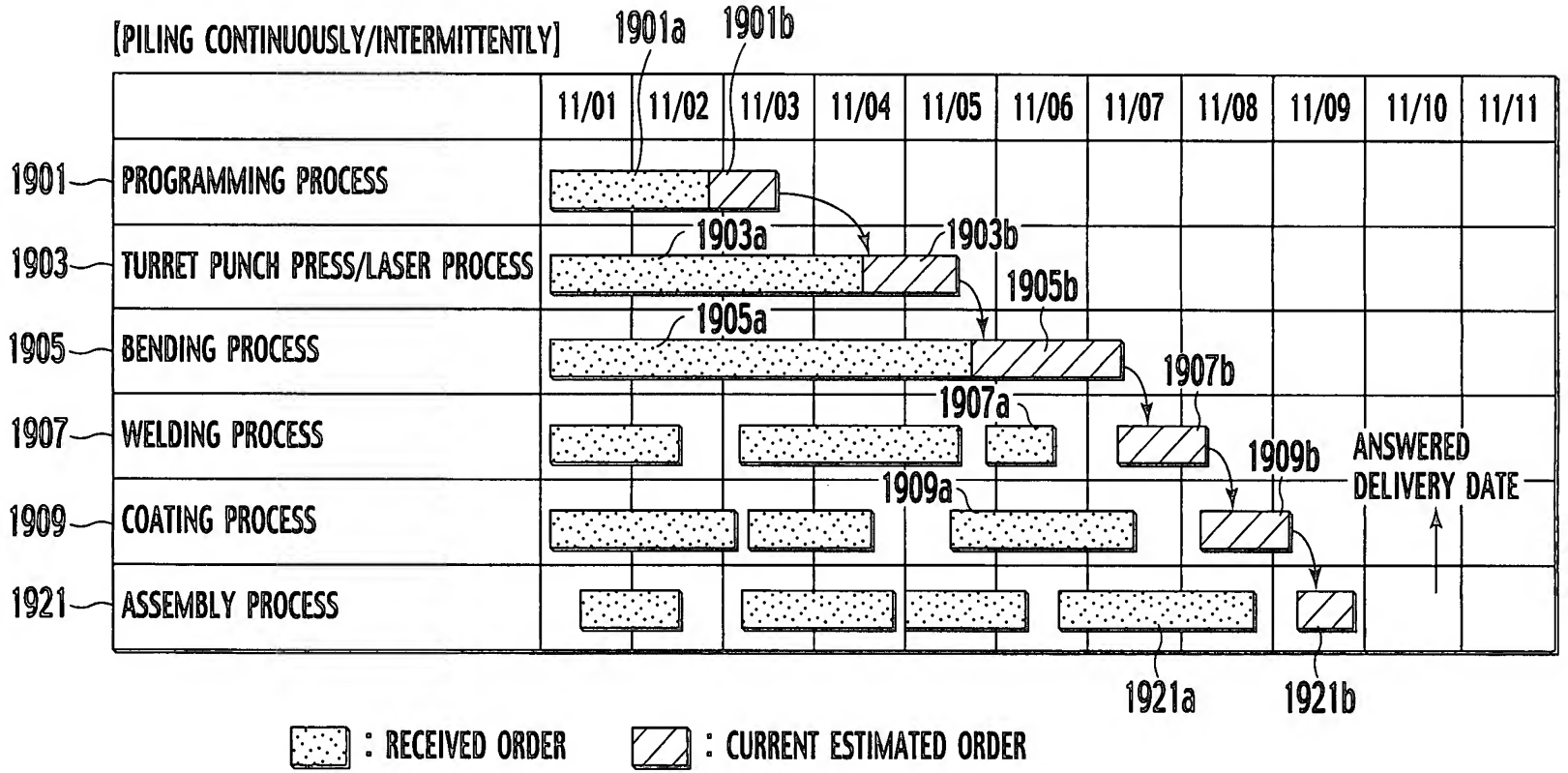
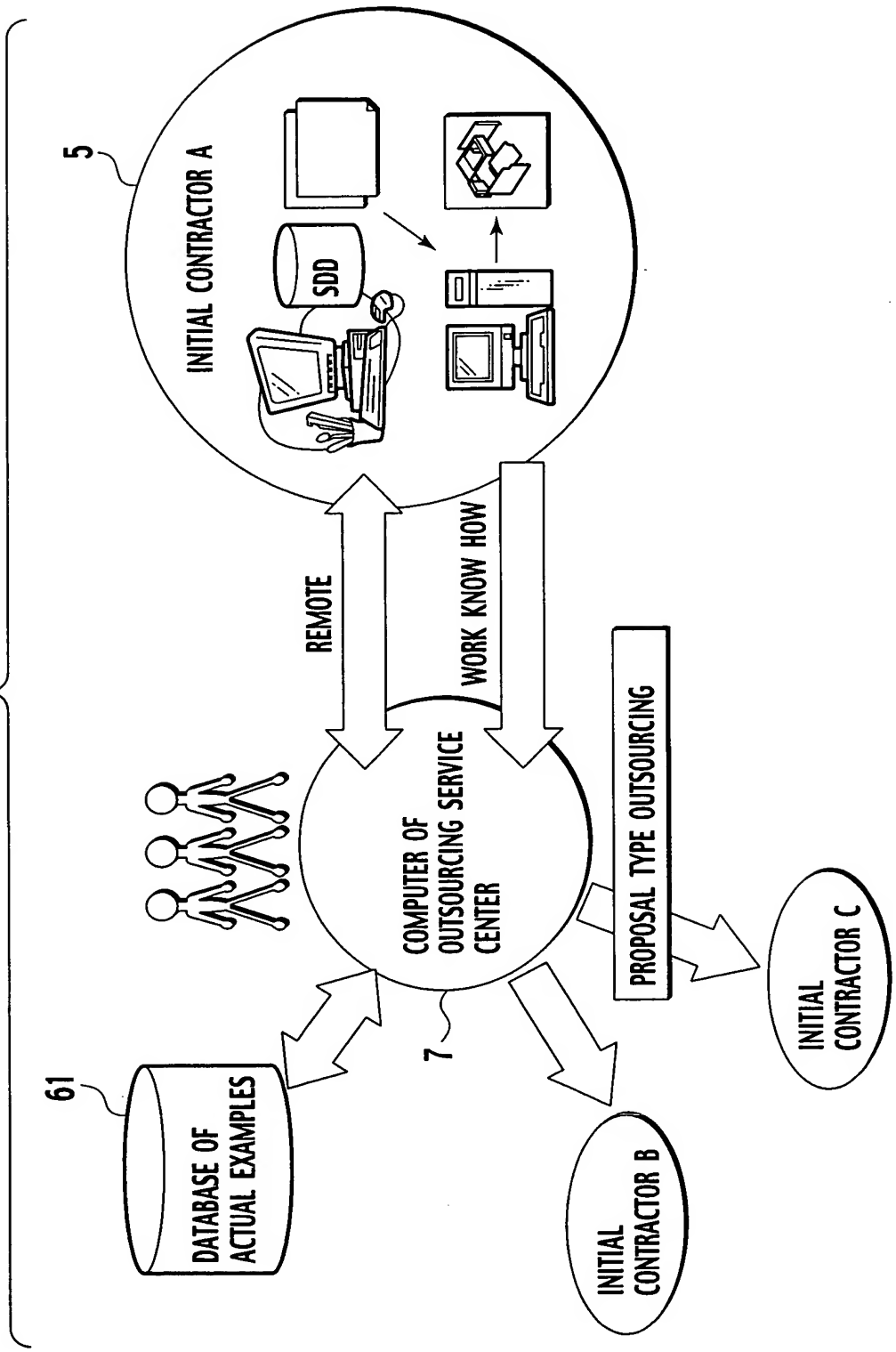

[PILING CONTINUOUSLY/INTERMITTENTLY]
1901a
1901b
11/01
11/02
11/03
11/04
11/05
11/06
11/07
11/08
11/09
11/10
11/11
1901
PROGRAMMING PROCESS
1903
TURRET PUNCH PRESS/LASER PROCESS
1903a
1903b
1905b
1905
BENDING PROCESS
1905a
1907b
1907
WELDING PROCESS
1907a
1909b
ANSWERED DELIVERY DATE
1909
COATING PROCESS
1909a
1921
ASSEMBLY PROCESS
1921a
1921b
: RECEIVED ORDER
: CURRENT ESTIMATED ORDER

FIG.20


5
INITIAL CONTRACTOR A
SDD
REMOTE
WORK KNOW HOW
COMPUTER OF OUTSOURCING SERVICE CENTER
7
61
DATABASE OF ACTUAL EXAMPLES
PROPOSAL TYPE OUTSOURCING
INITIAL CONTRACTOR B
INITIAL CONTRACTOR C